Sub C1

WHAT IS CLAIMED IS:

1. A method for performing virtual examination of an object comprising:

performing at least one scan of an object with the object distended by the presence of a contrast agent;

performing at least one scan of the object with the object relieved of the contrast agent;

converting the scans to corresponding volume datasets comprising a plurality of voxels;

performing image segmentation to classify the voxels of each scan into a plurality of categories;

registering the volume datasets of each scan to a common coordinate system;

displaying at least two of the volume datasets in a substantially simultaneous manner; and

performing virtual navigation operations in one of the volume datasets and having the corresponding navigation operations take place in at least one other volume dataset.

2. The method for performing virtual examination according to claim 1, wherein the at least one scan of the distended object includes a transverse scan and a coronal scan of the object.

3. The method for performing virtual examination according to claim 2, wherein the at least one scan of the relieved object includes a transverse scan and a coronal scan of the object.

4. The method for performing virtual examination according to claim 3, wherein the object is a bladder.

5. The method of performing virtual examination according to claim 4, wherein the scans are computed tomography scans.

6. The method of performing virtual examination according to claim 4, wherein the scans are ultrasound imaging scans.

7. The method of performing virtual examination according to claim 4, wherein the scans are magnetic resonance imaging scans.

8 The method of performing virtual examination according to claim 7, wherein the contrast agent is urine.

9. The method for performing virtual examination according to claim 1, wherein the at least one scan of the relieved object includes a transverse scan and a coronal scan of the object.

10. The method for performing virtual examination according to claim 1, wherein the object is a bladder.

11. The method of performing virtual examination according to claim 10, wherein the scans are computed tomography scans.

12. The method of performing virtual examination according to claim 10, wherein the scans are ultrasound imaging scans.

13. The method of performing virtual examination according to claim 10, wherein the scans are magnetic resonance imaging scans

14. The method of performing virtual examination according to claim 13, wherein the contrast agent is urine.

15. The method of performing virtual examination according to claim 1, further comprising evaluating the at least one scan with the object distended and the at least one scan with the object relieved to identify regions where contrast is more visible in one of said scans and evaluating the scan with more contrast in a region of interest to determine physiological characteristics of the object.

16. The method of performing virtual examination according to claim 15, wherein said step of image segmentation includes classifying voxels based on local intensity vectors of the voxels.

17. The method of performing virtual examination according to claim 16, wherein the step of image segmentation further includes using a region growing algorithm to identify regions of the object based on the classified voxels.

18. The method of performing virtual examination according to claim 1, further comprising partitioning the volume image datasets into a plurality of regions related to the coordinate system.

19. The method of performing virtual examination according to claim 18, wherein the plurality of regions include eight regions defined in a three dimensional coordinate system.

20. A method for performing virtual examination of an object comprising:

performing an imaging scan of the object to acquire image scan data;

converting the acquired image scan data to a plurality of voxels;

interpolating between the voxels to generate an expanded dataset;

performing image segmentation to classify the voxels into a plurality of categories;

extracting a volume of the object interior from the expanded dataset;

generating a reduced resolution dataset from the expanded dataset;

storing the expanded dataset in a tree data structure;

rendering images for the expanded dataset and reduced resolution dataset; and

selecting at least one of the reduced resolution dataset or expanded dataset renderings for display.

21. The method for performing virtual examination of an object of claim 20, wherein the selecting step comprises:

selecting the reduced resolution dataset during image interaction; and

selecting the expanded dataset rendering if no image interaction has occurred in a predetermined time period.

22. The method for performing virtual examination of an object of claim 20, wherein the imaging scan is a computed tomography scan.

23. The method for performing virtual examination of an object of claim 20, wherein the imaging scan is a magnetic resonance imaging scan.

24. The method for performing virtual examination of an object of claim 20, wherein the imaging scan is an ultrasound imaging scan.

25. The method for performing virtual examination of an object of claim 20, wherein the object is the larynx.

26. The method for performing virtual examination of an object of claim 20, wherein the tree structure is a binary space partition tree structure.

27. A method of performing virtual angiography comprising:

acquiring imaging scan data including at least a portion of the aorta;

converting the imaging scan data to a volume representation including a plurality of voxels;

segmenting the volume representation to classify the voxels into one of a plurality of categories;

analyzing the segmented volume representation to identify voxels indicative of at least a portion of an aneurysm in the aortic wall; and

generating at least one closing surface around the voxels indicative of at least a portion of an aneurysm to estimate the contour of the aneurysm.

28. The method of performing virtual angiography of claim 27, wherein the imaging scan is a computed tomography scan.

29. The method of performing virtual angiography of claim 27, wherein the imaging scan is a magnetic resonance imaging scan.

30. The method of performing virtual angiography of claim 27, wherein the segmenting operation classifies voxels in at least the categories of blood, tissue, and calcium deposits.

31. The method of performing virtual angiography of claim 27, further comprising estimating the volume of the aneurysm using the generated closing surfaces.

32. The method of performing virtual angiography of claim 27, further comprising generating a navigation path through the aortic lumen.

33. The method of performing virtual angiography of claim 32, further comprising estimating the length of the aneurysm based on the navigation path.

34. A method of performing virtual endoscopy of a blood vessel comprising:

acquiring imaging scan data including at least a portion of the vessel;

converting the imaging scan data to a volume representation including a plurality of voxels;

segmenting the volume representation to classify the voxels into one of a plurality of categories including the categories of blood, tissue, and calcium deposits; and

generating a navigation path through the vessel.

35. The method of performing virtual endoscopy of claim 34, wherein the vessel is a carotid artery.

36. The method of performing virtual endoscopy of claim 34, further comprising the step of determining the diameter of the carotid artery along the navigation path to identify regions of narrowing.

37. The method of performing virtual angiography of claim 34, wherein the imaging scan is a computed tomography scan.

38. The method of performing virtual angiography of claim 34, wherein the imaging scan is a magnetic resonance imaging scan.

39. A method of determining the characteristics of a stent graft using virtual angioscopy, comprising:

acquiring imaging scan data including at least a portion of the aorta;

converting the imaging scan data to a volume representation including a plurality of voxels;

segmenting the volume representation to classify the voxels into one of a plurality of categories;

analyzing the segmented volume representation to identify voxels indicative of at least a portion of an aneurysm in the aortic wall;

generating at least one closing surface around the voxels indicative of at least a portion of an aneurysm to estimate the contour of the aneurysm;

identifying the location of the endpoints of the aneurysm contour;

calculating the length between the endpoints of the aneurysm contour to determine the length of the stent graft; and

calculating the diameter of the aortic lumen at the endpoints of the aneurysm contour to determine the required outside diameters of the stent graft.

40. The method of determining the characteristics of a stent graft of claim 39, further comprising determining the angle of interface of the aneurysm and normal aortic lumen to determine an angular direction of a corresponding end of the stent graft.

41. The method of determining the characteristics of a stent graft of claim 39, further comprising locating arterial branches proximate the aneurysm to determine a maximum length of the stent graft.

42. The method of determining the characteristics of a stent graft of claim 41, wherein the arterial branches proximate the aneurysm include at least one of the renal and femoral arterial branches.

43. The method of determining the characteristics of a stent graft of claim 39, further comprising conducting a virtual biopsy of the aortic region proximate the ends of the aneurysm to determine the nature of the tissue at the anticipated graft interface locations.

44. A method of defining a skeleton for a three dimensional image representation of a hollow object formed with a plurality of voxels comprising:

identifying a root voxel within the hollow object;

generating a distance map for all voxels within the hollow object, the distance map being formed using a 26-connected cubic plate of neighboring voxels having Euclidian weighted distances;

identifying voxels having a local maxima in the distance map as endpoints of branches in the hollow object; and

for each local maxima voxel, determining a shortest connected path to one of the root voxel or a previously defined shortest path.

45. The method of defining a skeleton for a three dimensional image representation of claim 44 further comprising performing multi-resolution data reduction to the three dimensional image representation to generate a reduced data set for the generating and identifying operations.

46. The method of defining a skeleton for a three dimensional image representation of claim 44 further comprising centralizing the shortest paths within the respective branches of the object.

47. The method of defining a skeleton for a three dimensional image representation of claim 44, wherein the object includes at least one blood vessel.

48. The method of defining a skeleton for a three dimensional image representation of claim 44, wherein the object includes the airways of a lung.

49. The method of defining a skeleton for a three dimensional image representation of claim 44, wherein the object includes the bladder.

50. The method of defining a skeleton for a three dimensional image representation of claim 44, wherein the object includes the spinal cord of a vertebrate animal.

51. A method of performing computed assisted diagnosis of a region of interest, comprising:

acquiring imaging scan data including at least a portion of the region of interest;

converting the imaging scan data to a volume representation including a plurality of voxels, at least a portion of the voxels representing a surface of the region of interest; and

analyzing said portion of voxels representing a surface for at least one of a geometric feature and a textural feature indicative of an abnormality.

52. The method of performing computed assisted diagnosis according to claim 51, wherein the textural feature is included in a probability density function characterizing a correlation between two voxels of the portion of voxels.

53 The method of performing computed assisted diagnosis according to claim 52, wherein the two voxels are adjacent voxels.

54. The method of performing computer assisted diagnosis according to claim 52, wherein intensities of said portion of voxels are used to generate an estimate of the probability density function.

55. The method of performing computer assisted diagnosis according to claim 54, wherein a plurality of voxel intensities are used to generate a cumulating distribution function of the region of interest and a local cumulating distribution function, and wherein the local cumulating distribution function is compared against the context cumulating distribution function to identify regions of abnormality.

56. The method of performing computer assisted diagnosis according to claim 55, wherein a distance is determined between said local cumulating distribution function and said context cumulating distribution function, the distance providing a measure of abnormality.

57. The method of performing computer assisted diagnosis according to claim 56, wherein the distance is used to assign intensity values to the voxels representing a surface of the region of interest and wherein said method further comprises displaying said voxels such that variations in intensity represent regions of abnormality.

58. The method of performing computer assisted diagnosis according to claim 57, wherein the region of interest includes the colon and wherein the abnormality includes polyps.

59. The method of performing computer assisted diagnosis according to claim 51, wherein the region of interest includes the aorta and wherein the abnormality includes abdominal aortic aneurysms.

60. The method of performing computer assisted diagnosis according to claim 51 wherein the surface is represented as a second differentiable surface where each surface volume unit has an associate Gauss curvature and wherein said Gauss curvatures combine to form said geometric features.

61. The method of performing computer assisted diagnosis according to claim 59 wherein a plurality of predetermined geometrical feature templates are defined and wherein the geometric features of said surface are compared to said templates to determine a geometric feature classification.